

Controlling Shareholder's Equity Pledge, Corporate Finance and Corporate Innovation

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Abstract

Based on a sample of non-financial listed A-share companies in China from 2013 to 2021, this article examines the relationship between controlling shareholder equity pledge, corporate financialization, and corporate innovation. Research shows that controlling shareholder equity pledge hinders enterprise innovation. Enterprise financialization has a crowding out effect on enterprise innovation, and enterprises exhibit stronger speculative arbitrage motivation. Pledge of controlling shareholders' equity will promote the level of enterprise financialization. Enterprise financialization plays a partial intermediary role in the process of controlling shareholder equity pledge hindering enterprise innovation. Controlling shareholder equity pledge pushes out enterprise innovation by promoting enterprise financialization. The functional relationship between controlling shareholder equity pledge, corporate financialization, and corporate innovation only exists in listed companies on the Main-Board Market, but does not exist in enterprises on the GEM and SSE STAR Market. Based on further research from the perspective of financing constraints, it is found that there are also financing constraint channels for controlling shareholder equity pledge to hinder the process of enterprise innovation, and controlling shareholder equity pledge hinders enterprise innovation by intensifying financing constraints. Further analysis based on different motivations for financialization indicates that equity pledge of controlling shareholders does not affect enterprise innovation by promoting enterprises to increase or reduce short-term financial assets, but rather by promoting enterprises to increase long-term financial investment and thereby squeeze out investment in enterprise innovation. Financialization motivated by speculative arbitrage is the channel through which equity pledge of controlling shareholders affects enterprise innovation, However, financialization motivated by "reservoir" is not a channel for controlling shareholder equity pledge to affect enterprise innovation.

Keywords

Controlling Shareholder; Equity Pledge; Financialization; Enterprise Innovation; Financing Constraints.

1. Introduction

Affected by trade frictions and the COVID-19, China's real economy and capital market have been hit. It is urgent to accelerate the pace of innovation, improve innovation efforts, master core technology, so as to enhance core competitiveness and enhance their own resistance. "The 14th Five Year Plan" and the 20th National Congress of the Communist Party of China have made important discussions on innovation and development. Innovation is related to the overall core of modernization construction. Science and technology is the first productive force, and innovation is the first driving force. It is necessary to strengthen the dominant position of enterprises in scientific and technological innovation. ". According to the 10-year data from China Statistical Yearbook from 2011 to 2020, China's innovation driven development strategy shows vitality. In terms of innovation investment, Figure 1.1 shows that China's R&D

expenditure has increased year by year, and its share in GDP has also increased year by year. Especially from 2018 to 2020, the proportion of R&D expenditure in GDP has increased significantly. In 2020, the number of patent applications reached 5.19 million, and the number of patent authorizations reached nearly 3.64 million, up 218% and 279% respectively compared to 2011. In terms of enterprise innovation investment, Figure 1.2 shows that more and more industrial enterprises are carrying out R&D activities, the proportion of enterprises with R&D activities is also increasing year by year, and R&D expenditure is increasing year by year. In terms of enterprise innovation output, the number of effective invention patents reached 1.45 million in 2020, an increase of 620% compared to 2011, and enterprise innovation activities have become increasingly active. However, due to the lack of innovative spirit and the lack of relevant systems in China's physical enterprises for a long time, many physical enterprises have insufficient innovative thinking, low levels of R&D investment, and insufficient innovation capabilities. Innovation is an important means for enterprises to gain long-term competitiveness, and also a guide to the future direction of enterprises in the context of Chinese style development in the new era. To remain invincible in market competition, the only way is to increase innovation investment and improve their own innovation level. So, what are the factors that affect enterprise innovation? How to drive enterprise innovation?

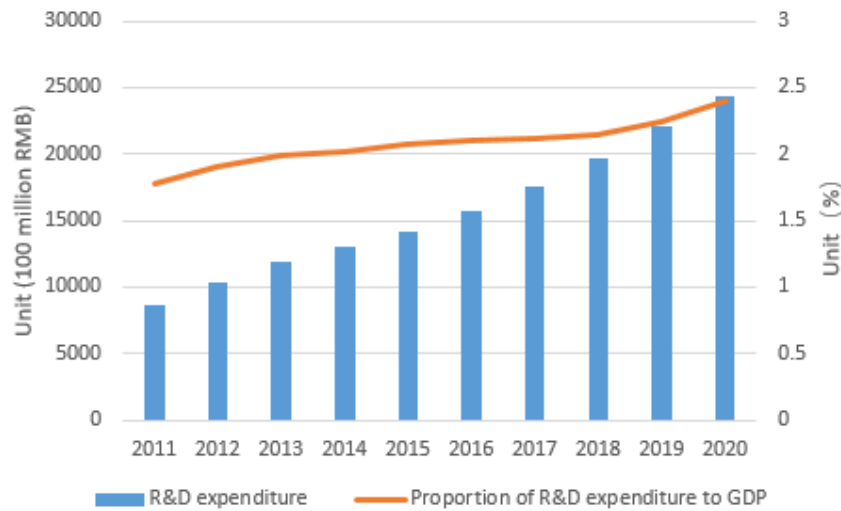


Figure 1. R&D expenditure in China from 2011 to 2020
Source: China Statistical Yearbook

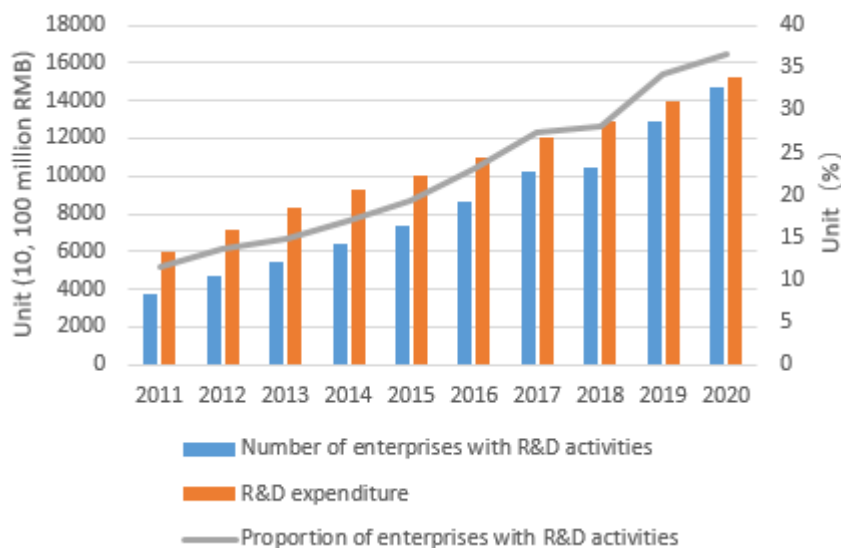


Figure 2. R&D activities of industrial enterprises above designated size in China
Source: China Statistical Yearbook

In order to actively explore the driving factors of innovation and promote enterprise innovation, this article examines the impact of controlling shareholder equity pledge and enterprise financialization on enterprise innovation from the perspective of enterprise equity pledge financing and financialization. This article empirically examines the relationship between controlling shareholder equity pledge, corporate financialization, and corporate innovation using sample data from non-financial listed A-share companies from 2013 to 2021. Based on the perspective of equity pledge and financialization, the scope of research on the factors affecting enterprise innovation has been broadened. From the perspective of equity pledge, the issue of whether enterprises prefer financial investment or innovative investment in asset allocation strategy selection has been studied. The causes and consequences of enterprise financial meltdown have been examined from both equity pledge and enterprise innovation, and the mechanism by which equity pledge affects enterprise innovation has been revealed from the perspective of financialization.

2. Journals Reviewed

2.1. Research on the Relationship between Controlling Shareholder's Equity Pledge and Enterprise Innovation

Most studies have shown that controlling shareholder equity pledge is not conducive to enterprise innovation. Pang and Wang (2020) found that equity pledge may be a channel to alleviate financial constraints of enterprises, but it cannot promote enterprises to increase investment in innovation. Li et al. (2018) found that controlling shareholders can reduce corporate innovation to reduce the risk of control transfer brought about by pledged stocks, and the combination of two positions exacerbates this negative impact. However, the pledge behavior itself has no significant impact on enterprise innovation, but only when the pledge rate reaches a certain level will it have an inhibitory effect. Gao and Zhang (2020) revealed the intermediary role of internal control in the relationship between major shareholder equity pledge and enterprise innovation. Gu and Bian (2021) found that equity pledge by controlling shareholders inhibits enterprise innovation by intensifying financing constraints, and tested the heterogeneity of the nature of property rights and investment preferences, as well as the regulatory effects of enterprise risk taking levels and the financial environment. Zhang et al. (2022) found that equity pledge significantly inhibits green technology innovation in enterprises, and financing constraints play a mediating role. Jiang et al. (2020) emphasized that enterprise innovation capability is the unity of innovation scale and efficiency. Therefore, they studied the impact of controlling shareholder equity pledge on innovation efficiency and found that it still has significant negative effects.

However, the impact of controlling shareholder equity pledge on enterprise innovation is not absolutely negative. During the period of equity pledge, in order to avoid the risk of closing positions, the pledgor can play an external constraint role, which may have a positive impact on the business operation of the enterprise (Hu, 2021). Chen and Liu (2021) conducted empirical research using a sample of A-share private listed companies and found that there is a threshold effect on the impact of controlling shareholder equity pledge on R&D investment. Lower pledge levels promote enterprise R&D investment, while higher pledge levels inhibit enterprise R&D investment. Feng et al. (2020) found that equity pledge by major shareholders of new energy enterprises can promote enterprise research and development investment.

2.2. Research on the Relationship between Enterprise Finance and Enterprise Innovation

Different motivations for financialization play different roles in innovation, and financialization based on investment vehicles can easily breed excessive financialization and have a crowding

out effect on enterprise innovation (Zheng et al., 2019). Based on the motivation of preventive reserve, it can supplement working capital, improve the insufficient investment of enterprises, and support enterprises to invest in sustainable research and development (Yang et al., 2017). Many literatures have confirmed the crowding out effect of enterprise financialization on enterprise innovation. Orhangazi (2008) used a sample study of non-financial enterprises in the United States from 1973 to 2003 to find that financialization has a "reservoir" effect and a crowding out effect on business activities. Seo et al. (2012), based on a study of non-financial listed companies in South Korea from 1994 to 2009, showed that increased financial investment and profit opportunities would crowd out enterprise R&D investment. Tori and Onaran (2018) also believe that purchasing financial assets will crowd out resources and reduce industrial investment and research and development expenditure. Duan and Zhuang (2021) found that investing in financial assets has a negative effect on both the input and output of enterprise technological innovation, and there is a lag effect. Enterprise financialization also has a positive effect on enterprise innovation. Yang et al. (2017) showed that holding transactional financial assets can promote enterprises' physical investment and sustained R&D investment. Research by Duan and Zhuang (2021) shows that there is a reservoir effect in corporate financial investment, but its promoting effect on corporate technological innovation cannot offset the crowding out effect on corporate technological innovation resources. Based on the positive and negative effects of enterprise financialization on enterprise innovation, some scholars have found that there is not a simple linear relationship between the two.

Some scholars believe that moderate financialization can promote enterprise innovation, while excessive financialization will crowd out enterprise innovation (Xu et al., 2022; Shu and Yu, 2020; Xie et al., 2021). There is an inverted U-shaped relationship between enterprise financialization and enterprise innovation (Xu et al., 2022). Dong and Chen (2021) showed that there is an inverted U-shaped relationship between the degree of financial appropriateness and enterprise innovation. The more a company's true financial level deviates from the degree of financial appropriateness, the stronger the crowding out effect on enterprise innovation; The closer the true level of enterprise financialization is to the degree of financial suitability, the stronger the boosting effect on enterprise innovation is displayed. Wang et al. (2017) found that the financialization of physical enterprises has a crowding out effect on enterprise innovation, and the allocation of financial assets by enterprises manifests as market arbitrage behavior. However, when the level of enterprise financialization exceeds a certain value, the crowding out effect on enterprise innovation is reversed to a promoting effect. That is, there is a U-shaped relationship between enterprise financialization and enterprise innovation.

2.3. Research on Controlling Shareholder Equity Pledge, Corporate Financialization, and Corporate Innovation

At present, there is little literature on the relationship between controlling shareholder equity pledge and corporate financialization, and most scholars only study the relationship between the two and its mechanism of action. Tang et al. (2019) pointed out that during the period of equity pledge, the decisions made by controlling shareholders on the operation of the enterprise due to market value management motivation will increase the financing constraints faced by the enterprise. As corporate financing constraints increase, in order to enhance capital liquidity and reduce financing costs, companies will increase financial investment in order to obtain high returns in a short period of time (Liu et al., 2021). According to Gu Haifeng and Bian Yuchen's research, equity pledge by controlling shareholders has a higher degree of inhibition on innovation investment after increasing corporate financing constraints. Therefore, the equity pledge of controlling shareholders will have a significant impact on corporate financialization and innovation investment. Wang and Zhang (2012) studied the impact of controlling shareholder equity pledge on corporate financialization through investor sentiment

based on the catering theory perspective, and found that controlling shareholder equity pledge can improve the trend of corporate financialization. In the context of equity pledge by controlling shareholders, financialization based on the "reservoir" motivation can alleviate financing constraints, feed back industrial investment, reduce the risk of closing positions, and promote sustainable development of enterprises; Based on arbitrage motivation, excess profits can be obtained, and profits can be manipulated through changes in the fair value of financial assets, thereby maintaining short-term stock prices and reducing the risk of control transfer. Yu and Yang (2022) pointed out that management's myopic behavior encourages them to favor financial assets with high investment returns and short cycles, while ignoring the long-term sustainable development of enterprises. During the period of equity pledge, controlling shareholders are already faced with a high risk of changing ownership of control rights, their self-interest motivation will increase, and their short-sighted behavior will become more obvious. Controlling shareholders tend to make decisions to improve the level of financial asset allocation of enterprises, which will increase the degree of enterprise financialization (Liu et al., 2021).

3. Impact Mechanism Analysis

3.1. The Influence Mechanism of Controlling Shareholder's Equity Pledge on Enterprise Innovation

The pledge of controlling shareholders' equity will bring a series of negative impacts. The pledge of controlling shareholders' equity will exacerbate the second type of agency problem, and the increased risk of ownership change of control rights will make it face the goal of maintaining stock prices. Therefore, it will increase the impact on business decision-making, and the "tunneling" motivation will also increase. Controlling shareholders also face higher default costs while obtaining funds through equity pledge. Controlling rights are more sensitive to controlling shareholders because once they lose control, they will not only lose some of the equity benefits, but more importantly, they will lose the additional benefits brought about by decision-making power. During the pledge period, once the stock price reaches the warning line, the pressure on the controlling shareholder to cover the position will be very high. If the full amount of funds cannot be recovered, and the stock price falls below the closing line, the pledgee will inevitably sell the shares to reduce losses, and at this time, the controlling shareholder will completely lose this part of the pledged equity. At this time, if the controlling shareholder holds fewer shares, it is bound to lose its controlling position. Therefore, the sensitivity of controlling shareholders to control forces them to take preventive measures in advance.

Due to the subjectivity of enterprise innovation investment in enterprise management decisions, which is easily controlled by the will of controlling shareholders, and the long cycle from input to output, high cost, great uncertainty, and high risk of enterprise innovation, the motivation of controlling shareholders to reduce enterprise research and development investment after equity pledge will significantly increase. On the one hand, reducing R&D and innovation investment for earnings management can whitewash the company's operating performance, release positive signals to investors, stabilize the company's stock price or drive the company's stock price up. On the other hand, the high risk of R&D innovation has deterred the controlling shareholders who are already facing the risk of control transfer, as once the R&D and innovation activities fail after investing a large amount of funds, the company's stock price will further decline, making it even worse for the controlling shareholders. Reducing investment in innovation can increase cash flow, and can also respond to potential position covering crises in the future, effectively preventing the risk of control transfer. Based on the above analysis, this article proposes the following assumptions:

Hypothesis 1: Controlling shareholder equity pledge will hinder enterprise innovation.

3.2. The Impact Mechanism of Enterprise Finance on Enterprise Innovation

Corporate financialization is mainly motivated by "reservoir" or speculative arbitrage motives. Firstly, financialization based on the "reservoir" motivation is beneficial to enterprise innovation. First, some highly liquid financial assets can serve as reserves to support enterprise innovation. Enterprise innovation requires a large amount of investment. When liquidity is insufficient, financial assets can be realized to support enterprise innovation activities. Therefore, financial assets that serve as a "reservoir" are beneficial to enterprise innovation. Secondly, the high returns obtained from some financial assets can be used to increase investment in innovation. Allocating some financial assets with high short-term returns and low adjustment costs can alleviate financing constraints and feed back physical investment and R&D innovation. Enterprises hold some long-term financial assets, although with poor liquidity, but can obtain high returns, which can increase the enterprise's disposable funds. The proceeds can be used to increase enterprise innovation investment, provide continuity for R&D and innovation activity funds, and thereby alleviate the financing pressure faced by enterprise innovation needs.

Secondly, financialization based on speculative arbitrage motivation is not conducive to enterprise innovation. With the gradual growth of financial investment returns, physical enterprises are more inclined to invest in financial assets to obtain higher returns and pursue profit maximization (Orhangazi, 2008; Peng et al., 2018). Enterprise liquidity can be invested in R&D and innovation activities, as well as used to purchase financial assets. Due to the high return on financial assets, flexibility and convenience, as well as the high uncertainty, high risk, and long return cycle of enterprise innovation, enterprises are more inclined to invest in financial assets. There is cash flow competition between different investment projects. If limited resources are invested more in financial assets, it is bound to reduce investment in R&D and innovation. There is a competitive relationship and crowding out effect between the two (Shu and Yu, 2020). Choosing to use enterprise resources for financial investment based on profit seeking goals represents a speculative demand, which is a short-sighted behavior and speculative arbitrage means of managers, and an encroachment on enterprise innovation resources (Duan and Zhuang, 2021). Therefore, financialization motivated by speculative arbitrage has a crowding out effect on innovation.

Based on the above analysis, the impact of financialization based on different motivations on enterprise innovation is different, so the following assumptions are made:

Hypothesis 2a: The "reservoir" of corporate finance is stronger and will promote corporate innovation.

Hypothesis 2b: Enterprise financialization has a stronger speculative arbitrage effect, which will crowd out enterprise innovation.

3.3. The Influence Mechanism of Controlling Shareholder's Equity Pledge, Corporate Financialization, and Corporate Innovation

According to the previous analysis, equity pledge by controlling shareholders will bring about the risk of control transfer, and also increase the motivation of controlling shareholders to "tunneling". After the controlling shareholders pledge their equity, if the company's stock price plummets, in order to avoid the risk of additional margin calls and closing positions, the controlling shareholders will take precautions by stabilizing the stock price and reserving current assets. During the pledge period, due to the "reservoir" motivation, investing in financial assets can be used for liquidity reserves. Financial assets with strong liquidity and short-term liquidity can be sold to obtain cash flow when funds are scarce, and can be used for margin calls. From the perspective of speculative arbitrage motivation, investing in financial

assets can obtain excess profits to whitewash business performance, thereby achieving the goal of stabilizing stock prices and reducing the risk of control transfer. From the perspective of agency issues, controlling shareholders may rely on their decision-making power over enterprise operations to exert pressure on management to ensure higher profits. The return on financial assets is high, and due to short-term performance pressure, management will prefer to invest in financial assets (Zhang and Zhang, 2016). Even if losses are caused, they can also be attributed to the uncertainty of the external environment (Xu and Yuan, 2021). Controlling shareholders can rely on their controlling position to allocate the limited resources of listed companies to the financial sector, and accordingly, the funds allocated to the main business will be reduced, thereby achieving the "tunneling" effect and obtaining additional control gains (Liu et al., 2021). Investing in financial assets can improve corporate performance in the short term, whitewash financial reports, and is not easily perceived by investors and regulatory authorities (Xiong and Dong, 2021). Therefore, after the equity pledge of controlling shareholders, the motivation for corporate financialization will increase. Based on the above analysis, the following assumptions are made:

Hypothesis 3a: Controlling shareholder equity pledge squeezes out enterprise innovation by promoting enterprise financialization.

Hypothesis 3b: Controlling shareholder equity pledge alleviates obstacles to enterprise innovation by promoting enterprise financialization.

4. Research Design

4.1. Sample Selection and Data Source

This article selects all A-share non-financial listed companies from 2013 to 2021 as research samples, and excludes risk warnings, delisted companies, and samples with incomplete data. All continuous variables are winsorized by up to 1%. The data is sourced from the Wind database and CSMAR database, and the model regression software is Stata15.0.

4.2. Variable Definition and Symbol Description

Table 1. Variable meaning and calculation method

Variable symbol	Variable meaning	Computing method
Rdt	Enterprise innovation	Total R&D investment/total assets
Ple_d	Whether the controlling Shareholder has equity pledge	At the end of the year, if the controlling shareholder has equity pledge, take 1, otherwise take 0
Ple_rt	Equity pledge ratio of controlling shareholders	Number of pledged shares held by controlling shareholders/number of shares held by controlling shareholders
Fin	Enterprise financialization	(Derivative financial assets+trading financial assets+financial assets available for sale+loans and advances issued+investment real estate+held-to-maturity investments+long-term equity investments)/Total assets
Age	Enterprise age	Number of years of establishment
Lev	Debt level	Total liabilities/total assets
Roa	Profitability	Net profit/total assets
Cfo	Operating cash flow	Net cash flow from operating activities/total assets
Laz	Operational efficiency	Current assets/operating income
TobinQ	Growth ability	(Total market value of stocks at the end of the year+total liabilities)/total assets
Top1	Shareholding ratio of controlling shareholders	Number of shares held by controlling shareholders/total share capital of the enterprise
Soe	Nature of property rights	The value for state-owned enterprises is 1, and the value for non-

		state enterprises is 0
Dual	Integration of two positions	If the chairman and CEO are the same person, take 1, otherwise take 0
Industry	Industry effect	Industry dummy variables
Year	Annual effect	Annual dummy variable

This article uses the ratio of enterprise research and development expenditure to total assets (Rdt) to measure enterprise innovation, and uses two indicators, namely, whether there is a controlling shareholder equity pledge at the end of the year (Ple_d) and the year-end controlling shareholder equity pledge rate (Ple_rt), to measure the controlling shareholder equity pledge. Enterprise financialization (Fin) is defined as the proportion of enterprise financial assets to total assets. Referring to the research conducted by Li et al. (2018), Wang and Zhang (2021), and Gu and Bian (2021), the following control variables are selected: enterprise age (Age), debt level (Lev), profitability (Roa), operating cash flow (Cfo), operating efficiency (Laz), growth ability (TobinQ), controlling shareholder shareholding ratio (Top1), property right nature (Soe), and dual employment (Dual), And control the annual and industry effects. The specific meaning and calculation method of variables are shown in Table 1.

4.3. Research Model

Hypothesis 1 examines the impact of controlling shareholder equity pledge on enterprise innovation, and this article constructs a model (1) to verify it. Where Rdt is the level of enterprise innovation; Ple is the pledge of the controlling shareholder's equity, using Ple_d and Ple_rt is measured by two proxy variables. Considering that the impact of controlling shareholder equity pledge on enterprise innovation may have a lag effect, this article lags behind the controlling shareholder equity pledge and all control variables for a period to reduce endogenous.

$$Rdt_{i,t} = \alpha_0 + \alpha_1 Ple_{i,t-1} + \alpha_2 Age_{i,t-1} + \alpha_3 Lev_{i,t-1} + \alpha_4 Roa_{i,t-1} + \alpha_5 Cfo_{i,t-1} + \alpha_6 Laz_{i,t-1} + \alpha_7 TobinQ_{i,t-1} + \alpha_8 Top1_{i,t-1} + \alpha_9 Soe_{i,t-1} + \alpha_{10} Dual_{i,t-1} + \sum Industry + \sum Year + \varepsilon \tag{1}$$

Hypothesis 2 examines the impact of corporate financialization on corporate innovation, and this article constructs a model (2) to test it. Fin refers to the level of enterprise financialization. To verify hypothesis 2a and hypothesis 2b, the following model is established:

$$Rdt_{i,t} = \gamma_0 + \gamma_1 Fin_{i,t} + \gamma_2 Age_{i,t-1} + \gamma_3 Lev_{i,t-1} + \gamma_4 Roa_{i,t-1} + \gamma_5 Cfo_{i,t-1} + \gamma_6 Laz_{i,t-1} + \gamma_7 TobinQ_{i,t-1} + \gamma_8 Top1_{i,t-1} + \gamma_9 Soe_{i,t-1} + \gamma_{10} Dual_{i,t-1} + \sum Industry + \sum Year + \varepsilon \tag{2}$$

Hypothesis 3 examines the mediating effect of corporate financialization. Referring to the practices of Wang and Zhang (2021), a mediating effect testing model is constructed by adding model (3) and (4) to model (1).

$$Fin_{i,t} = \beta_0 + \beta_1 Ple_{i,t-1} + \beta_2 Age_{i,t-1} + \beta_3 Lev_{i,t-1} + \beta_4 Roa_{i,t-1} + \beta_5 Cfo_{i,t-1} + \beta_6 Laz_{i,t-1} + \beta_7 TobinQ_{i,t-1} + \beta_8 Top1_{i,t-1} + \beta_9 Soe_{i,t-1} + \beta_{10} Dual_{i,t-1} + \sum Industry + \sum Year + \varepsilon \tag{3}$$

$$Rdt_{i,t} = \theta_0 + \theta_1 Ple_{i,t-1} + \theta_2 Fin_{i,t} + \theta_3 Age_{i,t-1} + \theta_4 Lev_{i,t-1} + \theta_5 Roa_{i,t-1} + \theta_6 Cfo_{i,t-1} + \theta_7 Laz_{i,t-1} + \theta_8 TobinQ_{i,t-1} + \theta_9 Top1_{i,t-1} + \theta_{10} Soe_{i,t-1} + \theta_{11} Dual_{i,t-1} + \sum Industry + \sum Year + \varepsilon \tag{4}$$

5. Empirical Analysis

5.1. Descriptive Statistics

From Table 2, it can be seen that the maximum value of Rdt is 10.2%, the average value is 2.3%, and the median value is 1.9%, indicating that China's A-share non-financial listed companies generally have low R&D innovation levels and relatively insufficient R&D investment. About

44.3% of listed companies have equity pledges from controlling shareholders at the end of the year, indicating that equity pledges from controlling shareholders have become an important source of external financing for enterprises. The maximum pledge rate reaches 100%, indicating that some controlling shareholders of enterprises have pledged all their shares, which may pose a significant risk of control transfer. The average level of enterprise financialization is around 6.4%, with a median of only 2.9%, indicating that some enterprises have a high degree of financialization, with a maximum of 46.8%. This indicates that very few enterprises are seriously "off the real to the virtual", deviating from their main business, which may have a significant impact on their business activities. Descriptive statistical results for other variables are consistent with normal levels, and will not be discussed in detail in this article.

Table 2. Descriptive statistics

Variable	N	Mean	S	Min	Median	Max
Rdt	17287	0.023	0.019	0	0.019	0.102
Ple_d	17287	0.443	0.497	0	0	1
Ple_rt	17287	0.240	0.334	0	0	1
Fin	17287	0.064	0.090	0	0.029	0.468
Age	17287	18.752	5.345	8.000	18.000	36.000
Lev	17287	0.399	0.199	0.052	0.385	0.870
Roa	17287	0.041	0.058	-0.251	0.040	0.195
Cfo	17287	0.048	0.064	-0.129	0.047	0.231
Laz	17287	1.236	0.801	0.195	1.040	4.857
TobinQ	17287	2.682	1.898	0.833	2.071	11.308
Top1	17287	0.406	0.156	0.107	0.396	0.771
Soe	17287	0.303	0.459	0	0	0
Dual	17287	0.295	0.456	0	0	1

5.2. Regression Results and Analysis of Main Models

5.2.1. Controlling Shareholder Equity Pledge and Enterprise Innovation

Table 3 reports the empirical regression results of the relationship between controlling shareholder equity pledge and enterprise innovation. Column (1) (2) shows the regression results that only control the industry and year without adding other control variables, indicating that equity pledge by controlling shareholders hinders enterprise innovation. However, the level of enterprise innovation investment may be affected by other factors, so the explanatory power of the above results may be weak. Column (3) (4) shows the regression results after adding other control variables. The coefficient of the dummy variable of equity pledge is -0.002, which is significant at the level of 1%, indicating that enterprises with equity pledge by controlling shareholders have less investment in innovation; The coefficient of equity pledge ratio is -0.006, which is significant at the level of 1%, indicating that as the proportion of controlling shareholders' equity pledge increases, enterprises' investment in R&D and innovation will decrease. The regression coefficients of most control variables are significant and consistent with practical economic significance, indicating that the selection of control variables is relatively reasonable. Overall, Hypothesis 1 has been verified.

Table 3. Regression results of controlling shareholder equity pledge and enterprise innovation

	(1)	(2)	(3)	(4)
	Rdt	Rdt	Rdt	Rdt

Ple_d	-0.001** (-2.45)		-0.002*** (-4.25)	
Ple_rt		-0.005*** (-7.24)		-0.006*** (-7.96)
Fin				
Age			-0.000*** (-3.78)	-0.000*** (-3.53)
Lev			-0.003** (-2.14)	-0.003* (-1.68)
Roa			0.018*** (4.18)	0.015*** (3.50)
Cfo			0.004 (1.12)	0.004 (1.09)
Laz			-0.003*** (-8.31)	-0.003*** (-8.27)
TobinQ			0.002*** (10.31)	0.002*** (10.13)
Top1			-0.007*** (-3.72)	-0.008*** (-4.27)
Soe			-0.002*** (-2.90)	-0.003*** (-4.00)
Dual			0.001** (2.37)	0.001** (2.29)
Constant	0.009*** (3.92)	0.010*** (4.20)	0.020*** (6.35)	0.020*** (6.57)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	17287	17287	17287	17287
adj. R ²	0.217	0.224	0.275	0.281

Note: *, **,*** Respectively represents significant at the 10%, 5%, and 1% levels, with the t-value adjusted by enterprise level clustering in parentheses, the same below.

5.2.2. Enterprise Finance and Enterprise Innovation

Column (1) of Table 4 reports the regression results of the relationship between enterprise financialization and enterprise innovation. The coefficient of enterprise financialization (Fin) is significantly -0.009 at the level of 1%, indicating that the overall performance of enterprise financialization on enterprise innovation is a crowding out effect. Enterprises' financial investment has a stronger speculative arbitrage effect, ultimately crowding out funds for R&D innovation. This validates hypothesis 2b.

5.2.3. Controlling Shareholder's Equity Pledge, Corporate Finance and Corporate Innovation

Column (2) (3) (4) (5) of Table 4 reports the test results of the financial transmission mechanism that controlling shareholder equity pledge affects enterprise innovation. Column (2) (3) is the regression result of model (3), and column (2) Ple_ The coefficient of d is 0.004, which is significantly positive at the level of 10%, indicating that enterprises with equity pledge by controlling shareholders at the end of the year have a higher level of financialization; The results in column (3) indicate that as the level of equity pledge by controlling shareholders increases, enterprises will increase their financial investment efforts. Overall, equity pledge by controlling shareholders will promote the level of enterprise financialization. Column (4) and (5) are the regression results of model (4). The coefficient of the dummy variable of equity

pledge in column (4) is significantly -0.002 at the 1% level, and the coefficient of corporate financialization is significantly -0.009 at the 1% level; The coefficient of equity pledge ratio in column (5) is significantly -0.006 at the 1% level, and the coefficient of corporate financialization is significantly -0.008 at the 1% level, indicating that both controlling shareholder equity pledge and corporate financialization have a negative impact on corporate innovation. Corporate financialization has a partial intermediary effect in the process of controlling shareholder equity pledge inhibiting corporate innovation, and controlling shareholder equity pledge squeezes out corporate innovation by promoting corporate financialization, This validates hypothesis 3a.

Table 4. Controlling shareholder equity pledge, corporate financialization, and corporate innovation

	(1)	(2)	(3)	(4)	(5)
	Rdt	Fin	Fin	Rdt	Rdt
Ple_d		0.004* (1.76)		-0.002*** (-4.19)	
Ple_rt			0.009** (2.36)		-0.006*** (-7.88)
Fin	-0.009*** (-3.20)			-0.009*** (-3.13)	-0.008*** (-3.01)
Age	-0.000*** (-3.43)	0.002*** (6.10)	0.002*** (6.03)	-0.000*** (-3.47)	-0.000*** (-3.23)
Lev	-0.005*** (-2.92)	-0.064*** (-7.25)	-0.065*** (-7.33)	-0.004** (-2.47)	-0.003** (-2.00)
Roa	0.019** (4.50)	0.041** (1.98)	0.045** (2.18)	0.018*** (4.25)	0.015*** (3.58)
Cfo	0.004 (1.28)	0.009 (0.51)	0.009 (0.51)	0.004 (1.14)	0.004 (1.11)
Laz	-0.002*** (-7.94)	0.005*** (2.74)	0.005*** (2.69)	-0.002*** (-8.16)	-0.002*** (-8.13)
TobinQ	0.002*** (10.09)	-0.003*** (-4.29)	-0.003*** (-4.19)	0.002*** (10.12)	0.002*** (9.94)
Top1	-0.006*** (-3.50)	-0.010 (-1.08)	-0.008 (-0.92)	-0.007*** (-3.78)	-0.008*** (-4.33)
Soe	-0.001* (-1.69)	0.004 (1.21)	0.005 (1.46)	-0.002*** (-2.86)	-0.003*** (-3.94)
Dual	0.001** (2.29)	-0.001 (-0.56)	-0.001 (-0.53)	0.001** (2.35)	0.001** (2.28)
Constant	0.020*** (6.51)	0.142*** (4.12)	0.141*** (4.09)	0.021*** (6.78)	0.022*** (6.97)
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
N	17287	17287	17287	17287	17287
adj. R ²	0.275	0.092	0.093	0.277	0.282

5.3. Robustness Check

The registration system was implemented on the Science and Technology Innovation Board in 2019 and the Growth Enterprise Board in 2020. The reform of the registration system in China's stock market has lowered the market access threshold, induced the capital market to serve the real economy, and has had a significant impact on listed companies and investors. In order to

reduce the impact of the implementation of the registration system, this article uses sample data from 2013 to 2018 for robustness testing, and the results are shown in Table 5. The test results show that the negative effects of equity pledge by controlling shareholders on enterprise innovation are still significant, some intermediary effects of enterprise financialization still exist, and the conclusion that enterprise financialization squeezes out enterprise innovation investment is still robust.

Table 5. Test results of replacement sample interval

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Rdt	Rdt	Fin	Fin	Rdt	Rdt	Rdt
Ple_d	-0.003*** (-5.60)		0.011*** (3.95)		-0.003*** (-5.33)		
Ple_rt		-0.006*** (-8.01)		0.021*** (4.86)		-0.006*** (-7.66)	
Fin					-0.014*** (-4.19)	-0.013*** (-3.95)	-0.014*** (-4.46)
Constant	0.017*** (5.09)	0.017*** (5.04)	0.172*** (5.26)	0.172*** (5.32)	0.019*** (5.24)	0.019*** (5.18)	0.018*** (4.62)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	11661	11661	11661	11661	11661	11661	11661
adj. R ²	0.262	0.267	0.098	0.100	0.265	0.270	0.261

5.4. Heterogeneity Analysis based on Different Listed Sectors

Table 6. Heterogeneity analysis results of different listed sectors

	Main-Board Market				GEM and SSE STAR Market			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Rdt	Fin	Rdt	Rdt	Rdt	Fin	Rdt	Rdt
Ple_d	-0.002*** (-4.30)	0.005*** (2.67)	-0.002*** (-4.22)		-0.001 (-0.92)	-0.000 (-0.15)	-0.001 (-0.92)	
Fin			-0.011*** (-3.85)	-0.012*** (-3.92)			0.007 (1.09)	0.007 (1.09)
Constant	0.014 (1.31)	0.059*** (2.67)	0.014 (1.39)	0.012 (1.19)	0.011*** (3.02)	-0.023 (-0.42)	0.011*** (3.07)	0.010*** (3.02)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13331	13331	13331	13331	3956	3956	3956	3956
adj. R ²	0.251	0.098	0.254	0.251	0.260	0.168	0.260	0.260

This article analyzes the heterogeneity of China's Main-Board Market, Growth Enterprises Market (GEM), and SSE STAR Market, and studies the impact of different listed sectors on the above conclusions. The results are shown in Table 6. The results show that the mechanism of controlling shareholder equity pledge in promoting enterprise financialization to squeeze out enterprise innovation, as well as the crowding out effect of enterprise financialization on enterprise innovation, only exists in the Main-Board Market, but does not exist in the GEM and the SSE STAR Market. This is because listed companies on the Main-Board Market are generally

relatively large and mature, with strong risk resistance capabilities, relatively low demand for R&D and innovation, and low dependence on technological innovation. Therefore, after the pledge of controlling shareholders' equity, the motivation to influence enterprise decision-making and reduce innovation investment will increase, and the inhibitory effect on enterprise innovation is relatively obvious. Due to the relatively low demand for innovation among listed companies on the Main-Board Market, it is not surprising that enterprises are crowding out funds invested in innovation for financial investment. In addition, listed companies on the GEM and the SSE STAR Market are highly dependent on innovation, and technological innovation is their core means of improving market competitiveness. Once their innovation capabilities are insufficient, they are likely to lose a large amount of market share, and the difficulty of financing will also increase. Therefore, their opportunities to reduce innovation investment have a high cost. Based on this, controlling shareholders of GEM enterprises and SSE STAR Market enterprises will not choose to reduce innovation investment to avoid the risk of control transfer after equity pledge, and the impact of increasing financial assets on innovation investment will not be significant.

5.5. Further Research

5.5.1. Test based on Financing Constraints

This article further examines the financing constraint channels that controlling shareholder equity pledge inhibits enterprise innovation. This article uses the SA index to measure financing constraints, $SA = -0.737 \times \text{Size} + 0.043 \times \text{Size}^2 - 0.04 \times \text{Age}$. Where Size refers to the natural logarithm of the total assets of the enterprise, and Age refers to the age of the enterprise (Hadlock and Pierce, 2010). This article examines the financing constraint channels using the test method of financialization channels, and the results are shown in Table 7. Some intermediary effects are significant, indicating that financing constraint channels exist. Controlling shareholder equity pledge hinders enterprise innovation by increasing enterprise financing constraints. This is because equity pledge by controlling shareholders will release signals of a shortage of capital contributions and limited financing capacity, resulting in increased financing constraints. However, there is a high degree of information asymmetry between the R&D and innovation activities of enterprises and investors, and the increase in financing constraints is even worse for R&D and innovation that require a large amount of funds. Enterprises will have to reduce innovation investment.

Table 7. Test results of financing constraint channels

	(1)	(2)	(3)	(4)
	SA	SA	Rd_t	Rd_t
Ple_d	0.082*** (6.04)		-0.002*** (-4.20)	
Ple_rt		0.093*** (4.19)		-0.006*** (-7.87)
SA			-0.001** (-2.41)	-0.001** (-2.33)
Constant	3.671*** (7.49)	3.699*** (7.53)	0.021*** (6.57)	0.022*** (6.77)
Controls	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	17287	17287	17287	17287
adj. R ²	0.457	0.456	0.277	0.282

5.5.2. Based on the Motivation Test of Enterprise Financialization

This article will further examine the impact on corporate innovation based on the specific motivation of corporate financialization after equity pledge by controlling shareholders. The short-term financial investment (F1) and long-term financial investment (F2) are used to measure the "reservoir" motivation and speculative arbitrage motivation of non-financial enterprises to hold financial assets, respectively. The specific calculation method is: F1=trading financial assets/total assets, F2=(derivative financial assets+financial assets available for sale+loans and advances issued+investment real estate+held-to-maturity investment+long-term equity investment)/total assets. The test results are shown in Table 8.

Table 8. Test results of financial asset holding motivation

	Short-term financial investment			Long-term financial investment		
	(1)	(2)	(3)	(4)	(5)	(6)
	F1	Rd_t	Rd_t	F2	Rd_t	Rd_t
Ple_d	-0.004*** (-4.26)		-0.002*** (-4.19)	0.009*** (4.01)		-0.002*** (-4.01)
F1		0.007 (1.51)	0.007 (1.31)			
F2					-0.015*** (-4.83)	-0.014*** (-4.64)
Constant	0.004 (0.93)	0.018*** (6.02)	0.020*** (6.32)	0.131*** (4.17)	0.020*** (6.74)	0.021*** (6.96)
Conttrolls	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	17287	17287	17287	17287	17287	17287
adj. R ²	0.184	0.273	0.276	0.100	0.276	0.278

Column (1) Ple_ The coefficient of d is significantly negative, indicating that equity pledge by controlling shareholders will lead to a reduction in short-term financial asset investment; Column (4) Ple_ The coefficient of d is significantly positive, indicating that equity pledge by controlling shareholders will lead to increased investment in long-term financial assets. This indicates that after the pledge of controlling shareholders' equity, in order to avoid the risk of control transfer, it is believed that investing in long-term financial assets will yield higher returns than investing in short-term financial assets, so it will reduce the allocation of short-term financial assets and increase the investment in long-term financial assets in order to obtain high returns, indicating that after the pledge of controlling shareholders' equity, the speculative arbitrage motivation for enterprise financialization is stronger. The coefficient of F1 in column (2) is positive, but not significant, indicating that short-term financial assets held by enterprises have no significant impact on enterprise innovation, and enterprises will not use the funds used for innovation investment to allocate short-term financial assets; The coefficient of F2 in column (5) is significantly negative, indicating that the holding of long-term financial assets by enterprises will crowd out investment in enterprise innovation, and enterprises will choose to crowd out funds for R&D innovation to invest in long-term financial assets in order to obtain high returns. This indicates that the "reservoir" of financial investment is not significant, while the speculative arbitrage effect is significant. Combining the results in column (3) (6), it is shown that controlling shareholder equity pledge does not affect enterprise innovation by promoting enterprises to increase or reduce short-term financial assets, but

rather by promoting enterprises to increase long-term financial investment and thereby squeeze out investment in enterprise innovation. Therefore, financialization motivated by speculative arbitrage is the channel through which controlling shareholder equity pledge affects enterprise innovation. However, financialization motivated by "reservoir" is not a channel for controlling shareholder equity pledge to affect enterprise innovation.

6. Conclusion

Based on a sample of non-financial listed A-share companies in China from 2013 to 2021, this article examines the relationship between controlling shareholder equity pledge, corporate financialization, and corporate innovation. The main conclusions are:

Controlling shareholder equity pledge hinders enterprise innovation. Enterprise financialization has a crowding out effect on enterprise innovation, and enterprises exhibit stronger speculative arbitrage motivation. Pledge of controlling shareholders' equity will promote the level of enterprise financialization. Enterprise financialization plays a partial intermediary role in the process of controlling shareholder equity pledge hindering enterprise innovation. Controlling shareholder equity pledge pushes out enterprise innovation by promoting enterprise financialization. The functional relationship between controlling shareholder equity pledge, corporate financialization, and corporate innovation only exists in listed companies on the Main-Board Market, but does not exist in enterprises on the GEM and SSE STAR Market. Based on further research from the perspective of financing constraints, it is found that there are also financing constraint channels for controlling shareholder equity pledge to hinder the process of enterprise innovation, and controlling shareholder equity pledge hinders enterprise innovation by intensifying financing constraints. Further analysis based on different motivations for financialization indicates that after the equity pledge of controlling shareholders, the enterprise will increase the allocation of long-term financial assets and reduce the allocation of short-term financial assets in order to obtain higher returns, demonstrating a strong speculative arbitrage motivation. The pledge of controlling shareholders' equity does not have an impact on enterprise innovation by promoting enterprises to increase or reduce short-term financial assets, but rather by promoting enterprises to increase long-term financial investment and thereby squeeze out investment in enterprise innovation. Financialization motivated by speculative arbitrage is the channel through which the pledge of controlling shareholders' equity affects enterprise innovation. However, financialization motivated by "reservoir" is not a channel for controlling shareholder equity pledge to affect enterprise innovation.

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